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Challenges in Balancing the Amount of Solution Information in Requirement Specifications for Embedded Products

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The CO_2 challenge – how to take it on

CO_2 Emissions = Population × GNP/Population × Energy/GNP × CO_2/Energy

Difficult to influence

Can be influenced
- Efficient energy consumption
- Efficient energy generation (renewable energy)

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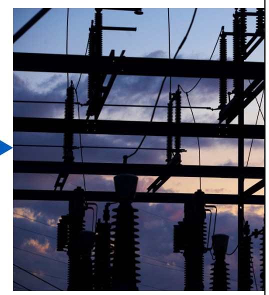
What is a solar inverter?

DC

AC



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From problem to solution

- Requirements are traditionally viewed as purely problem domain entities.
  - By preventing solution information in the requirements helps to prevent restricting the available design space prematurely
- In practice, separating the problem and solution domains can be difficult, and arguably there are benefits for not pursuing full separation
  - Customers may describe their requirements, as the difference between the existing products and the ideal product
  - Some customers have such intimate knowledge of the products that their requirements tend to be very specific
  - If the customer knows the exact solution needed that will reduce the cost of the requirements elicitation as well as design activities

From problem to a solution

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The challenge

- Practitioners are challenged to understand when having solution information in requirements is sensible and when it should be avoided.
- We advocate that researchers should identify different contexts and corresponding criteria that practitioners can use to evaluate when requirements specifications may include solution information.
- To understand the research challenge we present experiences from real projects and suggest possible factors that affect when solution information may be viable in requirements specifications.

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Standard-led design constraints

The inverter shall be approved according to the France standard, DIN VDE 0126-1-1 with some deviations described in the UTE C 15-721-1, for small-scale embedded generators in the low -voltage range.

- R4.3.2: Disconnection of mains and PV
  Triggering of an audible and/or visible alarm is required

R4.3.6: Earthing
The minimum size of GND cables has to be X mm2

R4.3.8: Marking
Special labels have to be placed on the inverter, see: I enclosure to UTE C 15-712-1, 15.2.3

- R4.3.8: Marking
  - Special labels have to be placed on the inverter , see: I enclosure to UTE C 15-712-1, 15.2.3

Supplier-Led Design Constraints

It shall be easy to identify the inverter -packaging in the warehouse. The inverter-packaging shall include a label . The label shall be easy -readable from a distance . The label must

The inverters must be able to be manufactured within the infrastructure of the existing production plant.
• All inverter versions must not exceed dimensions, hindering transportation on the existing production conveyer belts - within the dimensions of existing transportation trays, which have the dimensions LxW: L(a)xW(a) incl. test trane connection cables

The installation instruction shall be attached to the cover of the inverter.

Customer-Led Design Constraints

The inverter must fit the specific setup at the customer site . The customer requests a MC 4 or a Sunclic PV connector.

The inverter shall have a Maximum power point tracker

The inverter shall feature PV -sweep with basic functionality.

Sub-Contractor-Led Design Constraints

Example A:

All **screws** needed for mounting/installing shall be accessible from front

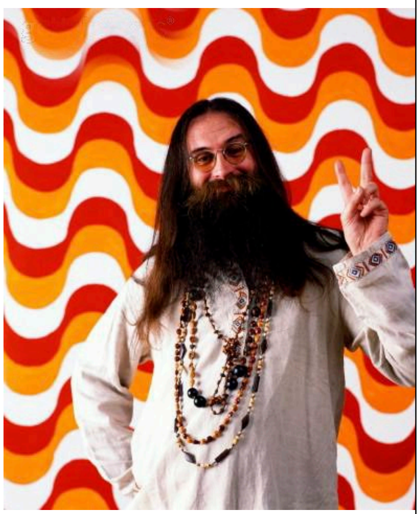
- All screws must be accessible from the front
- Except **X connection** and **Y screw**, which may be accessible from the bottom
- Except **Z plugs** and **cable glands** which may be accessible from the bottom

Example B:

X gland must be able to fit standard **Y connectors**, facilitating **two cables** using a **Z gasket**

Criteria

- **Technical knowledge of the customers**
- **Type of cooperation with the customers**
- Scope and structure of the specifications
- Stability and maturity of the company
- Size of the project
- Technical complexity
- **Technical maturity**
- Product maturity



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Reserch questions

- Are there common characteristics of development environments in which different categories of solution information are likely to have implications for project planning, risk management, requirements specification and requirements validation strategies for a given product development context?
- What processes are there for evaluating and communicating the relevant priority and impact (both reach and significance) of solution information that is a good fit with the product development context?
- What methods are there for reporting and manage the risks of including/excluding solution information?
- What methods are there for estimating the cost of including/excluding solution information?

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Questions, comments, or observations ?